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**GODDARD HANDBOOK FOR MANAGEMENT
OF
PROGRAMS - PROJECTS - PRODUCTS**

Volume 1

The NASA Program/Project Environment

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GODDARD SPACE FLIGHT CENTER

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GODDARD HANDBOOK FOR MANAGEMENT OF PROGRAMS – PROJECTS – PRODUCTS

Volume 1 – The NASA Program/Project Environment

Volume 2 - Program Management

Volume 3 - Project Management

Volume 4 - Product Management

Responsible Office: 401 Mission Integration Office

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VOLUME 1. The NASA Program/Project Environment

1.0 Introduction

Substantial changes within the National Aeronautics and Space Administration (NASA) and Goddard Space Flight Center (GSFC) have taken place since the last publication of the Flight Projects Directorate Project Management Handbook (August 1994). During the summer of 1998, the Center reorganization and its redirection made it necessary to update and expand the scope of this working document, as well as its title (i.e., The Goddard Handbook for Management of Programs – Projects - Products). Not only are those changes now a part of this Handbook, but the Handbook also brings this work into compliance with the International Organization for Standardization (ISO) 9001 requirements, the GSFC's Quality Manual (see GPG 8730.3), Goddard Procedures and Guidelines (GPG's), and NASA Program and Project Management Processes and Requirements (NPG 7120.5). Each Center is responsible for developing and implementing Center-level policies, processes, procedures, and requirements necessary to ensure successful program/project execution according to NPD 7120.4 and NPG 7120.5. (See NPG 7120.5, Para.1.4.)

The intent is to use this document as a Center-wide guide for all Program, Project and Product Managers who, as team leaders, will follow the applicable principles and direction of this Handbook. It is also for the use of all other Center personnel involved with Program – Project - Product management. The Handbook will be updated periodically to incorporate changes in NASA and GSFC directives.

This Handbook is the product of a multi-directorate team whose efforts were reviewed through various levels of GSFC management before final approval. For efficient use of this document, references are made to pertinent GPG's and NPG 7120.5, rather than to repeat their detailed requirements. Taking these documents together, the reader should be able to keep himself/herself aware of the fundamental areas and tools necessary to be successful in NASA's/GSFC's dynamic environment.

1.1 Program/Project/Product Relationship

A program is an activity within an Enterprise having defined goals, objectives, and funding, and consisting of one or more projects, reporting to the NASA Program Management Council (PMC), unless delegated to a Governing Program Management Council (GPMC). A project is an activity designated by a program and characterized as having defined goals, objectives, requirements, Life Cycle Cost's (LCC's), and a beginning and an end. The projects within the program may be independent of each other, or very dependent upon each other, in order to produce the customer-required products (see Figure 2-1 in Volume 2 for examples of independent and interdependent projects). Products include all deliverables subject to the GSFC Quality Management System (QMS), and may range from small items such as an aerospace lens brought to GSFC for polishing, to a suborbital payload and/or experiment/instrument, or major NASA spacecraft. Therefore products and services within the scope of the GSFC QMS, which includes those of flight programs and projects and elements thereof, must be compliant with GSFC QMS product requirements.

The major distinguishing features between a program and a project are as follows:

- a. A program is authorized by an Enterprise through a Formulation Authorization, while a project formulation is authorized by a program. However, Enterprise approval may be individually required for projects, which are competitively selected under programs, such as Explorers and Earth System Science Pathfinder (ESSP). Also, an Enterprise may authorize a project for formulation which has not been assigned to, or designated (itself) as, a program.
- b. Documentation required for programs approved for implementation includes the PCA and the Program Plan, while projects require a Project Plan and modifications to the Program Plan of which the project is an element
- c. A program is reviewed by the Agency PMC, unless delegated to a GPMC, while a project is reviewed by a GPMC as designated in the Program Plan.

The duration of a program is generally long term with new projects added on a regular basis. The projects within these programs are, however, finite, with a defined beginning and an end.

1.2 Strategic Planning/Strategic Enterprises

The NASA Strategic Plan establishes a framework of four Strategic Enterprises through which GSFC implements a mission and communicates with external customers and stakeholders (see NASA Strategic Plan and NASA Strategic Management Handbook.) These Strategic Enterprises are shown in Figure 1-1.

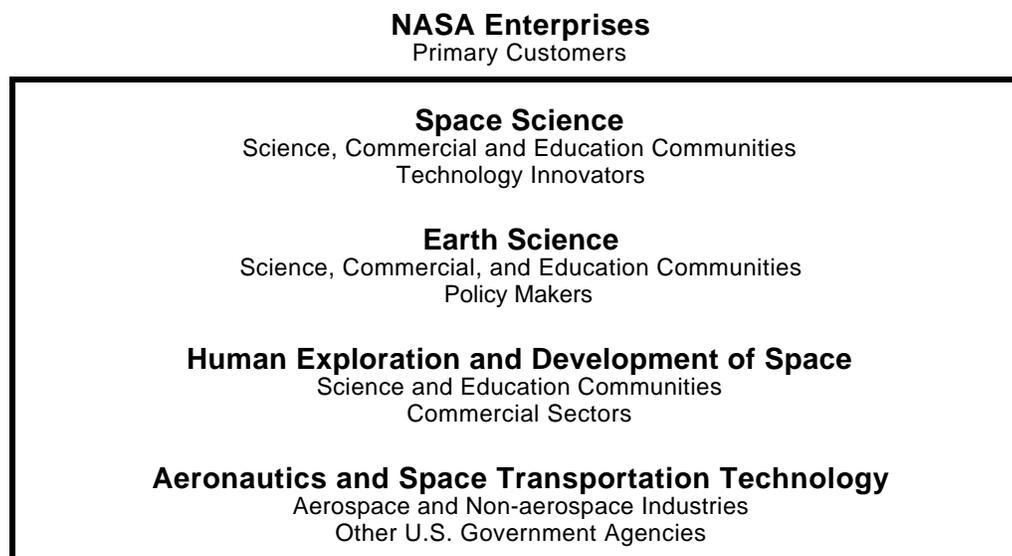


Figure 1-1. NASA's Strategic Framework

1.3 Critical Crosscutting Processes

Four Critical Crosscutting Processes (CCP's), which are the methods by which each Enterprise develops and delivers products and services to internal and external customers, are established in the NASA Strategic Management Handbook. These CCP's traverse Enterprises and the NASA infrastructure to satisfy NASA's goals and objectives that meet the needs of its customers as follows:

- Manage Strategically
- Provide Aerospace Products and Capabilities (PAPAC)
- Generate Knowledge
- Communicate Knowledge

The NASA Integrated Process Map, shown in Figure 1-2, provides a graphic illustration of these NASA CCP's and their interrelationships.

1.4 Integrated Processes

1.4.1 Critical Crosscutting Processes that Replace Phased Project Planning (PPP)

The four CCP's (Figure 1-2) are the primary activities by which NASA delivers to its customers the products and services required by the U.S. government. To more effectively provide these products and services, NASA has reengineered its framework for managing programs and projects, formerly known as Phased Project Planning (PPP). The new CCP's more broadly address NASA functions and services, and have more flexible guidelines for the conduct of their activities. The programs and projects are now managed in terms of subprocesses rather than phases.

Table 1-1 provides an overview comparison of the major elements of the new NASA PAPAC process elements with those of the former PPP approach.

The PAPAC process delivers space, ground, and aeronautical systems; technologies; services; and operational capabilities to NASA customers so they can conduct research, explore and develop space, and improve life on Earth. The PAPAC process includes both technology development to meet unique programmatic requirements and crosscutting technology development programs that support multiple applications.

**Table 1-1. NASA PAPAC Subprocess Elements Overview
PAPAC Compared to Phased Project Planning**

PAPAC Subprocess Elements	Former Phased Project Planning (PPP) Elements
Formulation	Pre-Phase A and Phase A (Conceptual, Feasibility, and Mission Analysis Studies) and Phase B (Definition and Preliminary Design)
Approval	Reports from Program Requirements Review (PRR); Non-Advocate Review (NAR); and such documents as the Program Commitment Agreement (PCA), Program Plan and the Program Cost Commitment (PCC) lead to project approval.
Implementation	Phases C (Design), D (Development and Operations Checkout), and E (Operations)
Evaluation	No Equivalent. Phased evaluation was conducted continually in sequential steps. The Evaluation subprocess adds systems of metrics to provide more visibility and objectivity.

1.4.2 The Four PAPAC Subprocesses in Summary

The following summarizes each of the four PAPAC subprocesses and describes the execution of the integrated process. Details on the GSFC process for implementing these subprocesses are found in paragraphs 3.1.2.2, 3.1.2.3, 3.1.2.4, and 3.1.2.5 of Volume 3 of this Handbook.

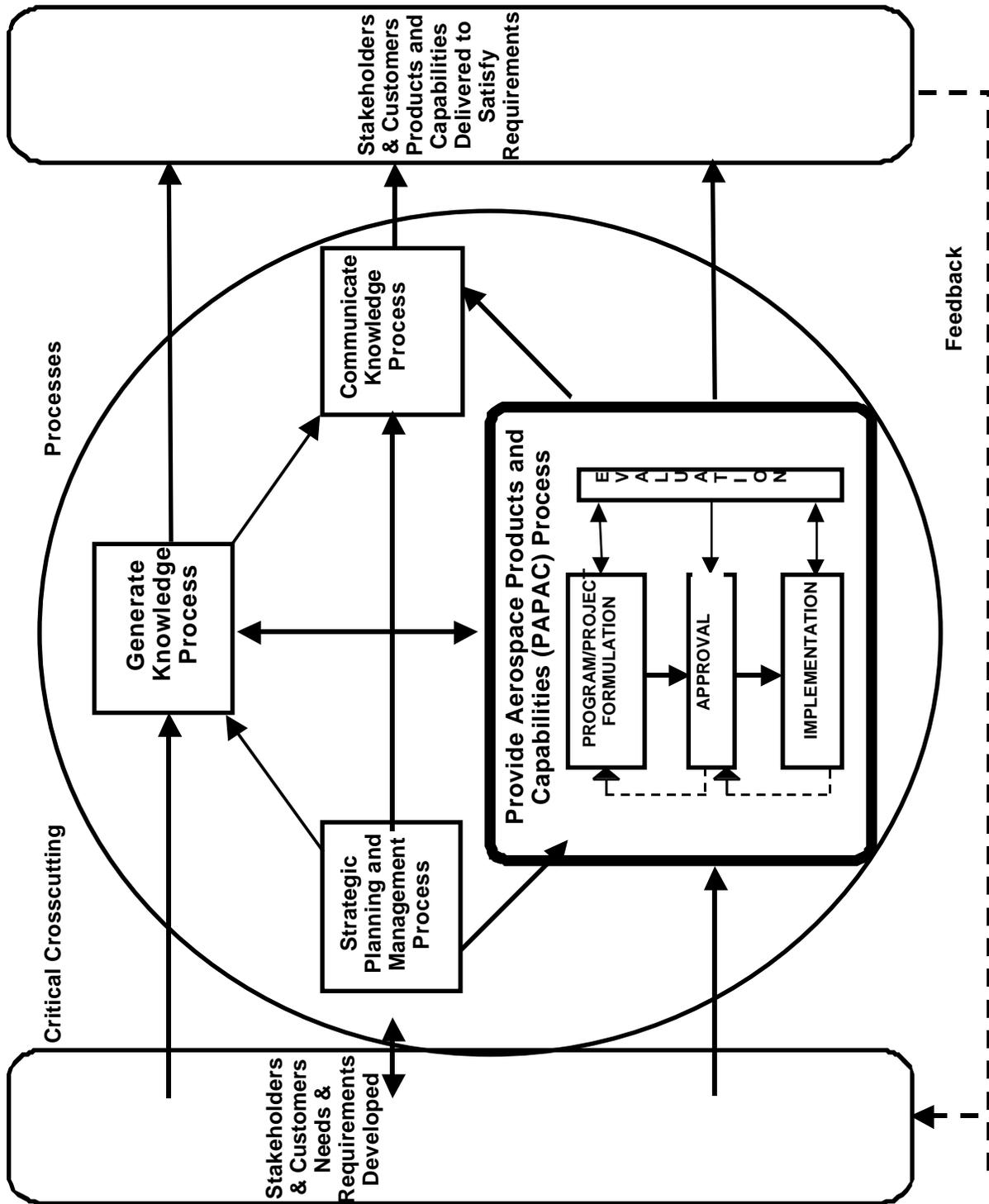


Figure 1-2. Interrelationships of Critical Crosscutting Processes

1.4.2.1 Formulation Subprocess

The purpose of the Formulation Subprocess is to define a program or project concept and plan to meet mission objectives or technology goals specified in either the NASA or Enterprise Strategic Plans. In the Formulation Subprocess, NASA/GSFC:

- Explores the full range of implementation options, including conceptual, technological, and operational approaches.
- Establishes the internal management control functions that will be used throughout the life of the program or project.
- Assesses the technology requirements and develops the plans for achieving the technology options, including options for partnering and commercialization.
- Performs Life-Cycle Cost (LCC) and performance analyses for feasible concepts.

The outcome of the Formulation Subprocess, documented in the PCA and Program/Project Plans, is as follows:

1. A comprehensive definition of program or project concepts and program/project performance objectives
2. Agreements, approaches, and plans for meeting the technical, budget, schedule, risk management, commercialization, acquisition, and related management system requirements

Throughout the Formulation Subprocess, Center-level routine reviews will inform all directorates of the subprocess status. This action is intended to satisfy ISO 9001/GPG 8700.1 requirements, and facilitate the transfer of the project between organizations as it moves from Formulation to Implementation. (Reference GPG 8700.1, especially Par. 2.8)

1.4.2.2 Approval Subprocess

The Approval Subprocess provides NASA senior management the opportunity to review and determine a program/project's readiness to proceed from Formulation through Approval to Implementation. Approval for a program or project to continue in the Formulation Subprocess may be provided where iterative formulation is required. This subprocess approves changes to the PCA and Program/Project Plans based on budgetary or technical issues or strategic redirection. NASA will only approve the baselining or rebaselining of those programs and projects that have firm cost, schedule, and content commitments. The outcome of the Approval Subprocess is as follows:

- The commitment to support the program or project as specified in the baselined or amended PCA, program plan, and project plan
- Authorization for the program or project to proceed to the Implementation Subprocess.

1.4.2.3 Implementation Subprocess

The purpose of the Implementation Subprocess is to deliver the program and project products and capabilities specified in the approved program and project requirements and plans. In the Implementation Subprocess, NASA/GSFC:

- Develops, integrates, and provides management control for the overall implementation approach.
- Works closely with customers to ensure mutual understanding of plans, objectives, and requirements.
- Converts and controls project and program requirements into implementation specifications.
- Develops the technology or systems design.
- Conducts manufacturing and testing.
- Establishes supporting infrastructure.
- Conducts operations.

1.4.2.4 Evaluation Subprocess

The Evaluation Subprocess provides independent assessments of the continuing ability of the program or project to meet its technical and programmatic commitments. These assessments are intended to add value in support of the Program – Project - Product Managers via the independent evaluations and recommendations. The Evaluation Subprocess occurs throughout the life cycle of the program or project to ensure the successful completion of Formulation, Approval, and Implementation Subprocesses. It uses the benefits of peer experiences, customer appraisal, and management expertise and tools in independent reviews of program or project concepts, plans, status, risk levels, and performance. Requirements for the reviews and assessments should be tailored, based on such factors as program and project size, criticality, and risk, and are detailed in Program/Project Plans. The outcome of the Evaluation Subprocess is a set of conclusions regarding the ability to meet commitments and recommendations for proceeding with, modifying, or terminating the program – project – product activities. Where appropriate, recommendations are also provided for enhancing overall performance.

1.4.3 Interrelationships of PAPAC to Other Critical Crosscutting Processes

Figure 1-2 illustrates the interrelationships of the four PAPAC subprocesses with each other as well as with NASA's three other CCP's. The PAPAC obtains its requirements from the Generate Knowledge and Communicate Knowledge processes (by way of scientific or technical research) and the Manage Strategically process (through strategic plans, policies, and resources). Within the PAPAC process, program and project concepts and plans, produced in the Formulation Subprocess, are evaluated and submitted for Approval Subprocess to proceed to the Implementation Subprocess. The Approval Subprocess provides initial approval and continues to support the change process of requirements and commitments. In addition, the Evaluation Subprocess supports the initial approval and continues to provide assessments by customers, experts, and stakeholders.

1.4.4 Integrated Process Themes

Several important themes that embody principles for executing program/project management in today's process-oriented environment recur throughout this document. They are described below:

a. Tailoring the Process

The program/project processes and requirements provide managers the framework to tailor approaches for formulating and implementing NASA's increasingly diverse programs and projects. While the program/project process and all requirements shall be addressed, managers can tailor approaches consistent with legal and regulatory requirements and program or project characteristics such as size, complexity, cost, criticality, and risk. Approved PCA's and Program/Project Plans will document the tailoring decisions. Requirements are contained in the process activities and management system requirements in Volume 2 and 3 of this Handbook and GPG 7120.1 Program Management and GPG 7120.2 Project Management.

In addressing the PAPAC process and requirements, tailoring is reflected in the decision to accomplish the following:

- Use the process and meet the requirement as stated
- Modify, simplify, or show how the process is addressed in another way with supporting description and rationale, and/or
- Modify the Project Manager's tools or management system requirements with supporting rationale.

b. End-to-End Customer Involvement

Managers shall identify customers and ensure that they are actively involved in program and project activities throughout the PAPAC process. Customer participation will increase the ability of the program or project to achieve customer objectives within established constraints.

c. Comprehensive Definition and Requirements Control

NASA shall only undertake programs and projects that have clearly defined objectives, are consistent with the NASA Strategic Plan, and have a comprehensive definition of cost, schedule, and content commitments. Agreements and requirements must be controlled throughout the program or project life cycle, from formulation through completion.

d. Risk Management

The Program or Project Manager shall apply risk management principles as a decision-making tool that enables programmatic and technical success. Program and project decisions shall be made on the basis of an orderly risk management effort, including the identification, assessment, mitigation, and disposition of risks throughout the PAPAC process.

e. Missions Enabled Technology

Enterprise objectives will be used to drive crosscutting technology programs by conducting end-to-end systems analyses of generic, reference missions. New technology products will expand mission horizons, and missions will evolve from a convergence of enterprise objectives and technology. This will promote development and rapid infusion of cutting-edge technology to enhance performance, reduce risk, and lower cost.

f. Technology Commercialization

Programs and projects will strive to enable the use of NASA technology by U.S. firms for commercial applications. Leveraging cooperative technologies and commercialization opportunities will maximize the commercial potential of new technology and its contribution to the national economy.

g. ISO 9001

NASA's priority for achieving and maintaining ISO 9001 certification reflects a commitment to implement high-quality, controlled, and defined work processes.

ISO 9001 complements NASA's existing quality management system. ISO 9001 provides a series of standards and guidelines that define a quality system accepted internationally. The 20 elements contained in Section 4 of the standard are:

- 4.1 Management Responsibility
- 4.2 Quality System
- 4.3 Contract Review
- 4.4 Design Control
- 4.5 Document and Data Control
- 4.6 Purchasing
- 4.7 Control of Customer-Supplied Product
- 4.8 Product Identification and Traceability
- 4.9 Process Control
- 4.10 Inspection and Testing
- 4.11 Control of Inspection, Measuring, and Test Equipment
- 4.12 Inspection and Test Status
- 4.13 Control of Nonconforming Product
- 4.14 Corrective and Preventive Action
- 4.15 Handling, Storage, Packaging, Preservation, and Delivery
- 4.16 Control of Quality Records
- 4.17 Internal Quality Audits
- 4.18 Training
- 4.19 Servicing
- 4.20 Statistical Techniques

The GSFC's Quality Manual (see GPG 8730.3) implements these elements, and their application is defined in a series of GPG's. Element 4.19, Servicing, is not within the current scope of GSFC's implementation of ISO 9001.

The PAPAC process and associated requirements provide the framework that shall be supported by these GSFC-certified processes.